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The history of botanic gardens in the United States.

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THE HISTORY OF BOTANIC GARDENS IN THE UNITED STATES.

OUTLINE.

I. Historical Introduction: changes in objectives between the 9th Century and the 20th Century; the botanic garden contrasted with the public park; verification of the use of "botanical" and "botanic".

II. The origin and development of botanic gardens in foreign countries.
   A. The medicinal garden of the 9th Century.
   B. The Italian botanic garden and its ideal.
   C. The English dual purpose botanic garden.

III. The establishment and development of botanic gardens in the United States.
   A. The foreign garden influence.
   B. The variable purposes of early botanic gardens.
      1. The gardens of John Bartram, David Hosack, Solomon Dronne, Andre Parmentier, and Thomas Hunt.
   C. The 20th Century botanic gardens as maintained for the advancement of botanical knowledge and science.
      1. Outstanding extant gardens: The National Botanic Garden, The Arnold Arboretum, The Missouri Botanical Garden, The New York Botanical Garden, The Brooklyn Botanic Garden, and The Boyce Thompson Southwestern Arboretum.

IV. Scientific significance of botanic gardens in the United States.

IV. (continued)

A. Influence of such gardens upon botanical science.

B. Influence of such gardens in cooperation with local and federal agencies, and upon the advancement of education.

V. Status of botanic gardens of the United States in the future.

A. Important and integral units in botanical science.

VI. Conclusions. High position of botanic gardens proportional to understanding of botanical science and increasing interest in education.

THE HISTORY OF BOTANIC GARDENS IN THE UNITED STATES.

PREFACE.

The modern world has been re-made by science. Botany, like any other science, has been an element in this transformation, though its constructive influence has possibly been overshadowed by the forces of destruction. Yet we may hope that the time will come again when its educational and scientific values will once more exert their influence.

Institutions that endure seem to have an inexhaustible momentum. Botanic gardens belong to this class of institutions. They are among the oldest surviving social institutions that have outlived political and religious upheavals, and economic depressions. Gager(1) states that "the most solid financial and educational foundations are laid, and the most efficient and enduring superstructure is begun, only when the vista of the far-distant future is kept before the mind's eye."

With this in mind, the author is here bringing to completion a thesis which had its beginning in a happier time.

THE HISTORY OF BOTANIC GARDENS IN THE UNITED STATES.

INTRODUCTION.

The history of botanic gardens in the United States follows a pattern which is not unlike that of the history of the United States itself. Botanic gardens have a mother country; botanic gardens have had religious, scientific, economic, and romantic aspects; botanic gardens have experienced times of depression and periods of prosperity; and botanic gardens have aligned themselves together for promulgation and fostering of high standards of educational values and scientific research.

Although there are many botanic gardens in the United States today, it is the intentionmof the author to indicate more specifically the advances made by such institutions as the National Botanic Garden, the Arnold Arboretum, the Missouri Botanical Garden, The New York Botanical Garden, the Brooklyn Botanic Garden, and the Boyce Thompson Southwestern Arboretum, along with a study of the earliest established gardens, for the purpose of showing the transition from and the relationships of the foreign gardens to the gardens in our country. The aims and objectives today are so pronounced and altered from those of the 9th Century gardens that it is necessary to trace the history of foreign gardens to explain the reasons for these changes.

A distinction should be drawn between the botanic or botanical garden and the park. A public park cannot be called a botanic garden because its purpose, aims, and objectives are distinctly different. Botanic gardens are planted and arranged in accordance with botanical considerations. Such gardens are not uncommon as adjuncts

to the botanical departments of colleges, or as special features of parks, but primarily a park is intended for recreation.

A modern garden (botanic) is more than a garden of gardens. It is an educational and scientific institution comprising two or more of the following features: plantations, conservatories, herbariums, libraries, laboratories, classrooms, lecture rooms, and an indoor botanical museum. The plantations are outdoor museums, whose exhibits are the living plants, arranged on some botanical basis, and labelled. This fundamentally differentiates a botanic garden from a perk, in which plants are arranged for landscape effects.

The use of the term "botanical garden", or "botanic garden", has been one of preference with the incorporators, or trustees, of the various gardens. Dictionaries list them together with identical meanings. The term "Botanic garden" was originally applied to the plantations; therefore, perhaps "botanical garden" is an all-inclusive term embracing every educational and scientific undertaking of these institutions.

THE ORIGIN AND DEVELOPMENT OF BOTANIC GARDENS IN FOREIGN COUNTRIES.

The origin and development of botanic gardens in foreign countries obviously has influenced the development of botanic gardens in the United States. The origin of gardens perhaps goes back to the dawn of history, to the Egyptians, Assyrians, and Chinese. Ancient Chinese rulers sent collectors to foreign lands for the sole purpose of gathering plants of economic and medicinal value. The exploits of Marco Polo opened trade routes for the same purpose. The author, however, is inclined to attribute the real founding of botanic gardens to the monks of the 9th Century, which represents monastic life at its pinnacle of development. Monasticism was the leading influence in the contemporary religious life, in education, in medicine, in communications, because of the going forth and return of the monks on pilgrimages.

The life and beliefs of the monks fostered ideal conditions for the study of plants. They had to do manual work; the monastery had to be self-sustaining; they enjoyed extraordinary security. They needed an outlet for their energies comparable to their spiritual beliefs; they could countenance no idle moments "for sin to enter into their lives". They were averse to surgery since they did not believe in spilling blood, yet they believed in healing the sick and in nursing the aged. It is only natural that they should cultivate medicinal plants and herbs, and should study their properties.

Botanical science is indebted to the monks for the care that they gave to their gardens, and for the

knowledge of plants and drugs that they passed on through the centuries from teacher to pupil.

Although the cloistered walls of Monte Cassino and of Salerno housed the greatest knowledge of medicine and of the properties of herbs (5), it was not long after the 9th Century that the rise of cities, universities, and the invention of the printing press gave vent to the dissemination of such important information.

Physic gardens became necessary adjuncts to the medical faculties of the universities. The garden at Padua, founded in 1545, still exists. These gardens were intended to give to the students ample opportunity for studying plants; for supplying materials for the compounding of drugs; and, of course, as sources of materials for future practice.

Rivalry between universities and the gardens, and a revived interest in plants, in the 16th Century stimulated expeditions and excursions for the collection of, as well as the exchange of, new plants. All kinds were cultivated, and descriptions with illustrations were sent far and wide. Prior to the middle of the 17th Century, such gardens as those of Bologna, Montpelier, Leyden, Paris, and Upsala were most noteworthy for fostering scientific instruction and research.

However, a taste for the ornamental and decorative, and a desire to cultivate the rare and unusual in their private gardens, was fostered by the nobility, the wealthy, and the prosperous. This taste reached its height in the 18th Century, and these same individuals often became the generous patrons of botanical science.

At that time most of the English botanic gardens were maintained for medicinal and scientific purposes. However, Dr. William Turner went to Bologna, where he

imbibed botanical knowledge from Lucas Ghums, and outstanding man of his time, returning to England to establish a "garden of rare plants" at Kew. That was in the middle of the 16th Century. Dr. Turner was one of the first English botanists, and became the superintendent of the first English botanic garden --- the garden at Syon House. A few years later, M. de l'Obel, for whom the flower Lobelia is named, was styled the Herbalist and Botanist to the Court of James. During the reign of Charles the 2nd, the garden at Chelsea was founded. Although they were called "Physic" gardens, they had "Royal" associations and affiliations.

The Oxford Botanic Garden, founded in 1632, was always a place of study and instruction. The botanist Evelyn visited it in 1654 when the sensitive plant was shown as a great wonder. In 1676, Sir Thomas Millington, a profesuor of Natural Philosophy at Oxford University, first expounded the fundamental fact of sexual reproduction in flowering plants. He suggested that the stamens were the male organs of such plants. A demonstration, showing experimentally the function of pollen, was given in 1681 by Jacob Bobart, "overseer of the physick garden". Robert Morison showed that asexual spores of ferns were the means of reproduction for that group of plants. As early as 1836, H. Daubeny anticipated J. W. Draper in demonstrating that light at the red end of the spectrum is most effectual in promoting the evolution of oxygen by plants.

Sometime between 1691 and 1694, Camerarius proved experimentally that plants have sex. He was the director of the Tubingen Botanic Garden at that time, and carried out his experiments in the garden. The first plant hybrids ever produced are attributed to the experiments of

Koelreuter. He was the director of the botanic garden at Karlsruhe. The foundations of the science of Genetics were made in 1866. Gregor Mendel, the Austrian Monk, experimentally bred the garden pea in the gardens of the monastery, and published a paper on plant hybrids. The existance of plants in botanic gardens has always stimulated and facilitated the study of plant life.

The garden at Chelsea was maintained by the Apothecary Company for the use of the medicinal students in London. It possessed the first English hothouse, crude as it may have been. In 1721, Sir Hans Sloane purchased the manor, but granted freedom of the garden to the Apothecary Company on certain conditions. The most important of these was that proviso which required the Professor, who gave lectures to the medical students, to deliver to the Royal Botanical Society 50 new plants annually until 2000 plants had been given. These plants were to be well-cured, specifically described, and grown in the garden. The interest of the Apothecary Company far exceeded these specifications because plants were delivered to the Botanical Society for 50 years. The Company also presented gold and silver medals annually to the best informed students in botany.

In 1839, the Royal Botanical Society, an incorporated organization, possessed 18 acres of land called Regents Park. It was designed by Marnock, and it comprised winter, landscape, and rock gardens; a conservatory; a library; and a museum. Both the natural and Linnaean systems of classification were used.

The Horticultural Society maintained gardens at Cheswick. In 1821 it had the richest collection of trees and shrubs in Europe. Primarily, the Society distributed seeds, plants, and cuttings to its members,

to foreign correspondents, and to the British Colonies.

Mention has been made of the Kew Garden. This garden has been the richest garden in England, not only in financial backing, but also in its collections of choice and rare plants. It was established by Princess Augusta, Dowager Princess, widow of the Prince of Wales, with the assistance of the Earl of Bute. All of the Hanoverian Princes, excepting George IV and William IV, have been interested in its undertakings. With the rise in power, wealth, and prestige, the British made a definite advance in the field of botanical science. The neglect of Kew by both George IV and William IV was more than offset by large collections of plants and seeds from Sir Joseph Banks. The spirit of exploration and adventure was the needed impetus for collectors and Government Agents to sail the seven seas, returning with rare and choice plants from the Colonies.

The herbarium at Kew received vast quantities of material from these governmental expeditions, and, under the influence of Sir W. J. Hooker, the curator, the garden was greatly extended and improved. One of the chief purposes of the garden was to promote scientific methods of nomenclature, identification, and classification. Correspondence with all of the botanical establishments of the Colonies was maintained and exchanges of plants and seeds were made.

THE ESTABLISHMENT AND DEVELOPMENT OF BOTANIC GARDENS IN THE UNITED STATES.

With the colonization of the American Land Grants came the establishment and development of the first botanic gardens in the United States. The "Physick Garden", or "Apothecaries Garden", was the forerunner of our modern, more ambitious institutions, just as it had been in the Old World. As early as 1653, a "Description of the New Netherlands" was written by a certain Adriaen Van der Donck, "Doctor of Both Laws".(12) In this manuscript he writes "of the Healing Herbs, and the Indigo", and one may gather from the following quotation the establishment of the first "Physick Garden", quaint as it may seem.

"A certain chirurgeon who was also a botanist, had a beautiful garden there (New Amsterdam), wherein a great variety of medicinal wild plants were collected, but the owner has removed and the garden lies neglected. The land is full of different kinds of herbs and trees besides those enumerated, among which there are undoubtedly good SIMPLICIA, with which discreet persons would do much good; for we know that the Indians with roots, bulbs, leaves, etc., cure dangerous wounds and old sores, of which we have seen many instances, ---".

Another early botanist was John Bartram. He lived from 1699 to 1777, and at an early age was inclined to study medicine as his life work. When still a young man, he purchased a tract of land three miles from Philadelphia, and built his own home. His intentions for the use of the land were correspondingly changed to fit a growing interest in the study of botany. The following quotation is but one of many items that give

an insight to his interest. "What a shame that thee shouldst have employed thy mind so many years in tilling the earth and destroying so many flowers and plants without being acquainted with their structures and their uses".(7)

From the day that he made that statement until his death, John Bartram botanized everything on his farm -- and a farm it was -- until his enthusiasm became so great that the products of his expeditions superseded the so-called products of his farm. He spent a great deal of time hunting for new specimens and rare plants, and he gladly paid his own expenses. Needless to say, these were days before Government commissions.

Not only was a wild species of plant saved from extinction by one of Bartram's botanical reconnaissances, but our gardens and parks today have been enriched with a new and beautiful shrub -- Franklinia altamaha.(3) It probably should be called Gordonia by the laws of nomenclature. In 1765, John Bartram, accompanied by his son William, made an excursion through the south. On the banks of the Altamaha River, near Fort Barrington, they discovered a beautiful tree, which was wholly unknown to botanists, and named it after Benjamin Franklin and the River. Twelve years later, when William was travelling alone, he rediscovered the tree, secured either seeds or cuttings, and planted them in his father's garden. The trees from these plantings produced seeds within five years.

Regardless of Dr. Alex Garden's condemnation of John Bartram's botanical knowledge (see footnote),

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"-- I have told him the classes, genera, and species of all that occurred, that I knew. I did this in order

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credit for establishing one of America's first botanic gardens goes to John Bartram of Philadelphia, a doctor by profession, but a botanist at heart.

David Hossack may also be referred to as an early American Medical botanist. Although he studied medicine and surgery as his profession, he was offered a professorship in Botany at Columbia University when he was only 26 years old. That was in 1795. Apparently he had a thorough training in the study of medicinal plants and herbs, and also possessed a keen interest in the botanical science of that day, because he accepted the professorship.

After 6 years of teaching, Hossack became so engrossed in and enthusiastic about his work that he purchased 20 acres of land about 3 1/2 miles from New York City for the purpose of starting a botanic garden. The Elgin Botanic Garden was the result of his efforts. The entire 20 acres was modelled after outstanding features of various gardens that he had seen in London. He paid his own expenses, built a fine conservatory, and purchased many tropical and exotic plants. After 10 years of great labor and painstaking care, he had accumulated a large and valuable collection of plants, including some 1500 American species.

Because the expense, time, and care needed to carry on the functions of the garden were beyond Hossack's means, the garden was transferred to the State of New

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to facilitate his enquiries, as I find he knows nothing of the generic character of plants, and can neither class them nor describe them, but I see that, from great natural strength of mind and long practice, he has much acquaintance with the specific characters; though his knowledge is rude, inaccurate, indistinct, and confused, seldom determining well between species and varieties --"

(7)

York by an Act of Legislature in 1810. It was to be known as the Botanic Garden of the State of New York. However, it was subsequently granted to the College of Physicians and Surgeons, and then to Columbia University where it was soon doomed to abandonment.

Nevertheless, Columbia University has benefited from its part in controlling and managing this plot of land. The Collegiate Dutch Reformed Church paid $18,000. for 16 city lots, and in 1900 another block was sold for $3,000,000. The most important transaction was yet to be made. The Elgin Botanic Garden, although 3 1/2 miles out of New York City in 1800, was the area between 47th and 51st Streets, and 5th and 6th Avenues of the 1900's. In 1929, John D. Rockefeller, Jr. leased the area between 48th and 51st Streets, from 5th to 6th Avenues, for an annual fee of $3,000,000. Rockefeller Center, with its roof-garden and garden terrace, is the "by-product" of a historic botanic garden.

At the same time that Dr. Hossack was laboring at his garden, Dr. Solomon Dronne of North Foster, Rhode Island, was working at the same interest. Dr. Dronne had been graduated from Brown University in 1773, and had received his Doctor of Medicine degree from the University of Pennsylvania. In 1801 he started collecting medicinal and rare plants from his friends in this country and abroad. Although he planned his garden for harmony, he was keen about arranging the plants by the Linnaean System of classification, the accepted system of the time.

Subsequent to this undertaking, he was appointed professor of Botany and Materia Medica at Brown University, keeping his private practice in medicine. He was to become a member of the American Academy of Arts and Sciences as a keen scholar and a skillful physician.

Prior to the abandonment of the Elgin Botanic Garden, Andre Parmentier was offered its superintendency in 1825. He spurned the offer and decided to have a garden of his own. Parmentier carefully selected and subsequently purchased 25 acres of land in Brooklyn for $4,000. The greenhouse that he erected was well-stocked with a great variety of trees and plants; some useful and ornamental, others exotic and indigenous. He has been given credit for first introducing the black beech and the mulberry. At the time of his death in 1830, he had swayed, more or less, from his original idea of a botanic garden to the maintainance of a thriving nursery. After all, he had to make a living, and his investment was so great that he had to commercialize it. Parmentier became known throughout the country for his introductions of many varieties of shrubs, vines, and flowers, vegetables, and trees. He was the first man who gained recognition for his botanic garden apart from any affiliation with the medical profession.

The first attempt to establish a public botanic garden was undertaken in Brooklyn in 1855 by Messers. Thomas Hunt, Henry A. Kent, William P. Langley, and about 40 subscribers. It was to be called THE HUNT HORTICULTURAL AND BOTANIC GARDEN. Apparently it was an offspring of the Brooklyn Horticultural Society, although Hunt endowed it with $50,000 and one-third of the land valued at $10,000; Kent endowed another $25,000 and one-third of the land; while Langley endowed $5,000 and the remaining third of the land. Most of the subscribers, who raised $30,000 were members of the Brooklyn Horticultural Society.

Stiles(11) states that the capital investment was $150,000, while Gager(2) says that the total endowment was $87,000 or nearly $10,000 more than the Brooklyn

Botanic Garden's endowment after seven years of existence. Either viewpoint is significant. It indicates an exceptional interest in plants for the times -- 1855.

Perhaps the opinion of an individual is more of a tell-tale clue to this seemingly large endowment than would be the Articles of Incorporation. Stiles' viewpoint is well expressed in the following statement. "The originators hoped to found a small garden which would contribute its fair share to the cultivation of the 'love of the beauty' and confer enduring honor".

By an Act of the Legislature of the State of New York, April 9, 1855, THE HUNT HORTICULTURAL AND BOTANIC GARDEN was incorporated "to improve and encourage horticulture; establish and maintain botanical, experimental, and ornamental gardens; and otherwise promote and extend the knowledge of horticulture, botany, and landscape architecture". These were significant aims and objectives, but the undertaking was abandoned after one year.

THE 20TH CENTURY BOTANIC GARDENS.

The modern botanic gardens of the United States hold unique and important positions in contributing to scientific advance and to education. Fundamentally, their origins have been based upon utility. It is obvious, therefore, that one of the fundamental elements, or functions, of a garden is the utilitarian aspect. Other important aspects are the scientific, the aesthetic and the philanthropic.

The utilitarian aspect of a botanic garden is strictly an economic one. The present day gardens have an extensive physical equipment with ample facilities needful to carry on scientific and experimental research. The herbariums, libraries, greenhouses, museums, and even the administration buildings, devote large areas and rooms to displays of both common and exotic plants. The greenhouses and research laboratories lend themselves to important investigations of all plants and their products, directly or indirectly useful to men. The staffs of botanic gardens undertake studies and problems related directly to forestry, to agriculture, to pomology, to floriculture, to pathology, to physiology, to ecology, to organic chemistry, and to bacteriology --- everyone of these an important scientific study in itself.

Seasonal exhibits of tender and hardy plants are emphasized both indoors and out-of-doors. The museums display mounted specimens, special photographs and plates, drugs, fibres, and woods as educational and scientific exhibits.

It would be difficult to draw a hard and fast line between the utilitarian and the scientific aspects of

our study since the two functions are necessarily more-or-less dove-tailed. The libraries, herbariums, museums, and laboratories are obviously more useful when they are thoroughly equipped and complete in their respective undertakings. All of the gardens do not bring into prominence the same activities. These differences are somewhat dependent upon local interests and conditions. Nevertheless, they do strive to maintain a balance and high standards in all of their activities. No botanic garden can maintain absolute perfection in all of its undertakings. Some gardens specialize in research work in taxonomy, others in morphology, or anatomy, and/or paleontology. With fully equipped laboratories, ample means, and an intelligent staff, successful prosecution of research in botanical science is inevitable.

The scientific possibilities of a garden are great but it reaches its maximum when an active, organic, and co-operative relationship exists between it and a university or other scientific institution. Such an arrangement affords facilities for the ready interchange of information with other sciences.

The aesthetic element of a botanic garden cannot be overlooked. The average person has an eye for the beautiful --- at least, natural beauty. The buildings, although indicative of the period of construction, harmonize and blend with the landscape. The roads, trails, paths, and plantings are all arranged with a decorative and tasteful effect. The topographical characteristics, in most cases, have been retained as the design of the gardens, with landscaping and plantings made in accordance with these features. Pools, brooks, swamps, hills, woodlands, and natural plantings have

been utilized extensively throughout the slow, but steady, enlargement of botanic gardens over a period of years.

Philanthropies and botanic gardens have reciprocal associations. Most of the present-day gardens have large endowments, scholarships, and prizes which have been given by wealthy patrons interested in the advancement of botanical science. Such philanthropies may be non-existent in the near future, if not already. Our present-day economic requirements leave little room for such outright endowments of yester-year. None-the-less, the botanic garden of to-day continues its policy of philanthropies to the people as it did centuries ago. It has been, and continues to be, an institution for the instruction, information, and recreation of the people. The facts concerning plants and plant products obtained through the studies and experiments by the staff are disseminated to the people at large, as well as to scientific institutions.

THE NATIONAL BOTANIC GARDEN.

The oldest botanic garden existing today in the United States is the National Botanic Garden in Washington, D. C. It was founded in 1820 under the auspices of the Columbia Institute for the Promotion of Arts and Sciences, an organization which was the outgrowth of an association known as the Metropolitan Society, and received its charter from Congress on April 20, 1818. The original purpose of the garden was "to collect, cultivate, and distribute the various vegetable productions of this and other countries whether medicinal, esculent, or for the promotion of arts and of manufacture."(8) The Botanic Garden continued under the direction of this Institute until 1837, when the Institute ceased to function as an active organization.

The Botanic Garden began functioning as a government-owned institution in 1842, but the records indicate that it was not until 1856, when the gardens were specifically placed under the direction of the Joint Committee on the Library, that a regular or annually recurrent appropriation was provided by Congress. In 1842 it became necessary for the Government to provide accomodations for the botanical collections brought to Washington from the South Seas by the United States Exploring Expedition of 1838-1842. Captain Charles Wilkes, the leader of this party, was ably assisted by Mr. William D. Brackenridge, horticulturist and assistant botanist to the expedition. The collection was temporarily placed on exhibition at the Patent Office. The first greenhouse erected to accomodate this exhibit was constructed in 1842 on a lot behind the Patent Office Building. (An) appropriation from Congress met the cost

of this undertaking.) The work was under the direction and control of the Joint Committee of Congress on the Library, and greenhouse construction continued for the next two years. When the collection of plants was finally housed, the Commissioner of Patents was given the custodianship of them, though the actual care was under the supervision of Captain Wilkes, assisted by William Brackenridge. This arrangement was to continue until 1850.

In 1849, Congress authorized the construction of an extension to the Patent Office Building. To make place for this addition, the Botanic Garden had to be relocated. In a deficiency bill approved May 15, 1850, Congress authorized this relocation, and directed that the appropriation for this purpose be expended under the direction of the Joint Committee on the Library. The bill reads as follows: "For the removal of the public greenhouse, and the botanical collection thereat, to some suitable site on the public grounds, and for the erection of such other greenhouses as may be deemed necessary by the Joint Committee on the Library, five thousand dollars, to be expended by said Joint Committee, and under the supervision of the Commissioner of Public Buildings." The site selected was at the west end of the Capitol Grounds, and was practically the same site as when the Botanic Garden was controlled by the Columbia Institute.

Ever since the garden began functioning as a government institution, in 1842, the Joint Committee on the Library has had connections with it, although it was not until 1856 that the Committee assumed permanent jurisdiction over the Garden. The Botanic Garden is operated and maintained solely from appropriations

provided annually by Congress. The annual appropriation for the fiscal year ending June 30, 1939 was $81,000 for salaries and $33,350 for maintenance. The appropriation for the fiscal year 1857, as contained in the Legislative, Executive, and Judicial Appropriation Act approved August, 1856, provided for the maintenance of the gardens, including the employment, $5,000. The appropriation is as follows:- "For maintaining the Botanic Garden and greenhouses, including pay of horticulturist and assistants, under the direction of the Library Committee of Congress, $5,000."

In attempting to make a comparison of these appropriations, one has to keep in mind that in 1856 the garden was in its initial stages, and that botanical science at the time was in its infancy. Today, it is a million dollar establishment that compares favorably with others of its kind as an educational and display institution.

The site selected in 1850 continued to serve as the main Botanic Garden site until 1933, when it was destined to be transferred to its present site on Independence Avenue. Action towards this relocation was initiated by Congress as early as 1925 so that the area of the Botanic Garden would be included as part of the Mall Development. The project of relocation was finally authorized by Congress, and it was completed in January, 1933. This project, which included the purchase of land and the construction of the conservatory and other buildings, amounted to the grand total cost of $1,875,500.

The present purpose of the United States Botanic Garden is significantly different from the original purpose in 1837. The present purpose is to collect, cultivate, and grow the various vegetable products of this and other countries for exhibition and display

to the public, and to provide study material for students, scientists, and garden clubs.

The principal display material is located in the main conservatory, which is approximately 262 feet long, 183 feet wide, and 40 feet high. The collection includes a large variety of palms, cycads, ferns, cacti, and other miscellaneous tropical cool-house plants, many of which are rare species. The collections and displays attract nearly 200,000 visitors yearly, including botanists, students, horticulturists, and the general public. If this is a criterion of success, then the efforts of the staff to develop the garden as a place of lively interest have given satisfactory results.

Annual floral exhibits were inaugurated in 1935 by the Architect of the Capitol, who has served as Acting Director of the Garden since July, 1934. Exhibits of seasonal display include the following:- Easter lilies, roses, calceolarias, spring flowering bulbs, azaleas, rhododendrons, chrysanthemums, poinsettias, and cyclamen. The luxuriant fruiting of the banana, orange, lemon, tangerine, papaya, averroa, kumquat, coffee, and Surinam cherry may be seen in their proper seasons. The entire collection of the Garden includes over 8,000 species and varieties.

The main property of the United States Botanic Garden covers three city squares, or approximately five and one-half acres. In addition, there are several adjacent reservations and a nursery under its control. The nursery contains some twenty-two acres and includes eight greenhouses located in another part of the city and known as Popular Point Nursery. It is used for the purpose of propagation, and for growing plant material for use and display in the conservatories and grounds

and also in the landscape treatment of the grounds about the Government buildings.

The entire square of land adjacent to the main conservatory serves as an outside garden site for the display of hardy, herbaceous, evergreen, and deciduous plant materials. This square also contains a small conservatory used for exhibition purposes, housing collections of citri, crotons, camellias, and other cool-house plants.

The United States Botanic Garden makes no contributions to the science of botany, and has no affiliations with other institutions, except in so far as the exchange of plant material is concerned. The legislation covering such exchanges is to be found in the Act approved July 8, 1935, Public 200, 74th Congress, and is as follows:- "Hereafter plant material exchanges may be made with botanic gardens, institutions, municipal parks, and gardens."

The Botanic Garden does not have an herbarium or a museum. Its library, if one would refer to it as such, contains less that 100 books.

The Garden, though not operated as a scientific institution, offers educational facilities, in that it makes available to students, botanists, floriculturists, and scientists many rare and interesting specimens for study. Every year botanical specimens are received from all over the world with requests for identifications. This is one of the services rendered by the Garden; at the same time it furnishes information relative to the proper methods of growing these plants.

There are no scientific or educational bulletins published or issued by the United States Botanic Garden, although instructive information is furnished in response

to individual requests. All other information pertaining to it may be found from year to year in the Annual Report of the Architect of the Capitol.

THE ARNOLD ARBARETUM.

One of the world's most famous, unfinished living monuments to plant science is the Arnold Arboretum. The philanthropy of James Arnold of New Bedford, Massachusetts, coupled with the vision, enthusiasm, determination, and conviction of Professor Charles Sprague Sargent, transformed a marginal deiry farm of Massachusetts into a scientific institution unsurpassed in the world. The period of transformation has been a period of trials. To begin with, the philanthropist did not know how the bequest was to be used, and the first director did not know what was expected. There was no deliberate planning of the Arboretum; its high position in the scientific world today is the result of fortuitous but most fortunate circumstances.

When the will of James Arnold was probated, it was found that one and one-fourth of twenty parts, or approximately $100,000, was put in trust of Messrs. George B. Emerson, John J. Dixwell, and Francis Parker of Boston. This trust was "to be applied for promotion of Agricultural and Horticultural improvement, or both Philosophical and Philanthrópic purposes at their discretion; and to provide continuance of this trust to such persons, and on conditions as they, or the majority, may deem proper to carry out the intentions of the donor."

Two of these trustees were very much interested in

trees, and realized the importance of establishing an institution for the study and cultivation of trees. As a matter of fact, through the efforts of Mr. George B. Emerson, the author of TREES AND SHRUBS OF MASSACHUSETTS, the President, Trustees, and Fellows of Harvard University signed an agreement with the Trustees of this Arnold bequest whereby the University would fulfill "the intentions of the donor". This was a significant agreement because the permanency and safety of whatever materialized in the future would be as lasting as Harvard University.

By March, 1872, the staggering sum of more than $103,000 was the "working" endowment; the Trustees of Harvard had made arrangements to utilize the Bussey farm of 125 acres in West Roxbury for the noble undertaking of growing every tree and shrub in New England that could stand the open ground.

In November of the following year, Professor Charles S. Sargent was appointed Director of the Arnold Arboretum and Arnold Professor of Dendrology. At that time he was the Director of Harvard's own Botanic Garden -- famous for its herbarium and library, from which voluminous and invaluable contributions to taxonomy and morphology have been made. It had one of the most complete gardens, libraries, museums, laboratories, and herbaria in existence. It took a man of Sargent's caliber to accept guardianship of a farm, nearly ruined by excessive pasturage, and make a scientific institution out of it.

However, with $3,000 working capital, with courage, fortitude, but without equipment, without a library, without collections of plants, and without support or encouragement of the people, Professor Sargent accepted

the challenge, and gradually improved the Arboretum until it was the best in the world. The natural features of the farm, such as the hemlock grove, the pond, the meadows, the swamps, the cliffs, and the brook were to be the basis of the primary design of this new and distinctive undertaking. All landscaping and plantings were to fit into this basic design.

The tremendous needs of cultivation and improvement were always in excess of the working budget, making it impossible to do anything but maintain a fixed program. Fortunately for the future of the Arboretum and for the City of Boston, the noted landscape architect, Frederick Law Olmsted, became interested in the incorporation of the Arboretum with the Boston City Park System. At that time he was laying out plans for the park system. He became very friendly with Professor Sargent, who saw great possibilities in his suggestions.

The two worked together for ten years upon a constructive plan before they were able to convince an apathetic public, the antagonistic authorities at Harvard, and the elected officials of Boston that their arrangement had many advantages for all concerned. In 1882, the following conditions were agreed upon:- The City of Boston took title to the land, and leased it back to the President and Trustees of Harvard University for a period of one thousand years for one dollar per year, with a proviso for a renewal of the lease for another one thousand years. The City of Boston was to add certain lands, construct and maintain roads and walks, police the grounds, and assume all taxes. The University in return was to open the grounds to the public from sunrise to sunset.

Even before this desirable consummation, Director Sargent realized the significance and necessity of extensive plant exploration throughout the world. Such expeditions were made for the purpose of collecting plants for the improvement of the grounds and for the enlargement of the herbarium. Professor Ernest H. Wilson was in charge of many of these expeditions, and he is credited with many of the most important collections of plants at the Arboretum today. He devoted many years of valuable service to the enlargement of the herbarium.

As early as 1878, the Arboretum was the recipient of the first collections from Eastern Asia. William S. Clark, President on leave fromthe Massachusetts Agricultural College, and founder of the college at Sapporo, Japan, sent a small collection of native seeds to his friend, Director Sargent. Included in this collection was the Tree Lilac (Syringa japonica), the Evergreen Bittersweet (Euonymous radicans vegetus), and the Sargent Cherry (Prunus sargentii). These were the first specimens of their kind in America. Other plants that also had a similar early introduction to New England through the offices of the Arboretum were Thunberg's barberry and clematis. The seeds of these came from the Botanic Garden at Petrograd.

In 1881 the herbarium included the first important collection of North American forest trees. This large assemblage undoubtedly was the result of the extensive travels and explorations made by Sargent himself and his assistants when he was making a survey for the United States Government. He was commissioned in 1877 to make a report on the forests and forest wealth of our nation.

Through the generosity of Mr. H. H. Hunnewell,

the administration building, containing the herbarium and the library, was built and presented to the University in 1892. That was a most timely and appropriate gift. Sargent's personal botanical library of some 6,000 books was growing rapidly, and the Arboretum had received 1,000 specimens of plants from Japan -- the first collection of its Asiatic plants. The new library and herbarium had an auspicious beginning. The herbarium was completely fire-proofed, being constructed of steel from the floor to the ceiling, and it was built large enough to hold 1,000,000 herbarium sheets. It is unfortunate that the need for a fire-proof library was unforeseen at the time of construction. It houses a priceless collection of photographs, books, and publications.

The Arboretum has the best collection of books on woody plants in the world, barring the assemblage at the British Museum. The value of this collection depends, in no small part, upon a duplicate set of the Jesup Collection of North American Woods. The original collection is exhibited at the Museum of Natural History in New York City. Although it was brought together under Professor Sargent's direction, it is more valuable than the original since it contains original water color paintings of the flowers and the fruits of the trees, made by Mrs. Sargent.

With increased donations of new shrubs and trees from interested friends and collectors, the Arboretum has expanded from the original 125 acres to the present extent of approximately 260 acres. As early as 1894, the President and Fellows of Harvard University purchased an additional 75 acres to be called Peter's Hill.

This tract of land was part of the old Bussey farm, and since the need of additional land was imminent it was decided to retain as much of the farm as possible. At several times over the years, the City of Boston has added various tracts of land to it, with the most recent addition consisting of some fifteen acres.

During all of the 72 years of the life of the Arboretum, it has assembled and nurtured all that is beautiful, interesting, and hardy among woody plants, not only of North America, but from the flora of the entire world. It has played an outstanding part in the advancement of arboriculture. One may call it an experiment station:- It serves foresters, landscape architects, fruit growers, park administrators, nurserymen, and botanists alike. The collection of living plants is made up of more than 5,000 kinds of trees, vines, and shrubs all systematically arranged. The species and varieties belong to 87 families and to 325 genera, as classified by the Linnaean System. The Arboretum willingly distributes surplus materials, and acts as a clearing house for seeds and plants, at the same time popularizing American trees and shrubs.

The Arboretum seeks knowledge for knowledge's sake, and garners information for the use of the amateur, the student, and the specialist. Outstanding work in pathology, taxonomy, and genetics has been carried on in its laboratories. Measures for controlling and eradicating the deadly fungus that infects beech trees have been undertaken, and in no small manner the staff has assisted in the study and control of the Dutch elm disease.

During the 54 years of Professor Sargent's directorship, the Arboretum amassed a wealth of material for

interpreting living plants. The needs for studies in the various phases of plant life were well recognized by Professor Sargent, but the lack of funds and facilities were always the chief obstacles to be surmounted. As a matter of fact, gifts and donations of money from friends and admirers generally were only sufficient to balance the budget; year after year the current expenses always exceeded the income from the endowment.

To insure the permanency and progress of the Arboretum after Sargent's death in 1927, these same people undertook to raise $1,000,000., to be paid in five years, as an endowment to the memory of Professor Charles Sprague Sargent. It was to be called the "Charles Sprague Sargent Memorial Fund". The amount was raised, despite many hardships, by committees that had been formed in Boston, Chicago, Philadelphia, New York, and many other cities.

One of the first disbursements from this fund went for the enlargement of the research staff in the departments of plant pathology and plant cytology. Professor Oakes Ames, famous Curator of the British Museum and newly appointed Supervisor of the Arnold Arboretum, was in sympathy with Professor Sargent's ideas. He was influential in the purchase of costly equipment to fit the needs of these new departments.

Throughout the entire development of the Arboretum, the educational program has been developed correspondingly. The Journal of the Arnold Arboretum was published for 10 years beginning in the year 1887. It was a weekly Journal devoted to articles on Forestry and Horticulture. It offered a means for prompt distribution of important and useful information concerning studies and activities at the Arboretum.

The first issue of the Bulletin of Popular Information was distributed in May, 1911. This bulletin was mailed without charge every week in the Spring and Autumn until 1915. At that time the second series was published and mailed at a price of $1. per year. This bulletin has contained articles on the idiosyncrasies, and has given an appraisal of the ornamental and the economical value of hundreds of plants. This information has been exceptionally useful to park commissioners, nurserymen, and landscape architects.

In 1919, the more advanced and highly technical Quarterly Journal appeared. Under the guiding influence of Professor A. Rehder, who had been appointed Curator in 1918, it served as a vehicle of publication for scientific papers of staff members. Yet Professor Rehder desired that the Quarterly should contain other articles as well, upon such interesting topics as descriptions and relationships of new species, notes on trees and shrubs, notes on the vegetation of countries visited, letters from correspondents, news about the Arboretum, additions to the library and herbarium, and projects of interest to botanists, horticulturists, and friends of the Arboretum. The periodical has been a highly successful undertaking.

The Arnold Arboretum is the only place in this country where records of the behavior of woody plants have been kept for over 70 years. Although it is not a school of landscape architecture or of forestry, it has contributed directly to successful silvicultural and landscape practices by disseminating information on the scientific, economical, and cultural properties of woody plants. The Arboretum continues to carry on

its original aim:- To provide facilities for the study of trees and shrubs of the whole world, but especially of North America. The Arboretum is a monument to the hard work, perserverance, diplomacy, and skill of one man --- Charles Sprague Sargent.

It is evident that an arboretum is a specialized botanic garden, concentrating intensively on types of plants, primarily trees and shrubs; it is necessarily limited in scope by the environmental factor.

THE MISSOURI BOTANICAL GARDEN.

Unlike James Arnold, who never knew how his philanthropy was going to be used, Henry Shaw of St. Louis, Missouri, had planned and supervised his garden for 25 years before "Shaw's Garden" was to be controlled by a Board of Trustees of the Missouri Botanical Garden as directed by the terms of his Will.

Henry Shaw, who had come from England with a knowledge of the cutlery business, finally settled in St. Louis in 1819. He became a very successful, pre-Civil War businessman, retiring at the age of 40. Self-denial combined with an excellent practical philosophy were instrumental in amassing a fortune of $250,000. for this man, who was quiet, modest, well-educated, and retiring.

Henry Shaw returned to his native country in 1851, making a side trip to Continental Europe. As an outcome of this trip to the First World's Fair in London and a visit to the private gardens of Chatsworth came the idea of having a garden of his own - and it was this dream which subsequently became the Missouri Botanical Garden.

In 1857, he engaged Dr. George Englemann to visit, examine, and obtain information about the botanic gardens which were in existence so that he might improve his own private gardens at Tower Grove Park. At the same time a letter from Sir William J. Hooker, Director of Kew Gardens, contained the following:- "--- Very few appendages to a garden of this kind are more important than a library and ecomomic museum, and these generally increase like a rolling snow-ball."(6) Thereupon, Shaw had a library and museum built in 1858, and he assigned the task of selecting the books to Dr. Englemann and his botanist friends. One of the first things that he recommended was the purchase of the herbarium of Professor Bernhardi, of Erfurt, Germany, which was for sale at a comparatively low price.

From the very beginning of his undertaking, Shaw was desireous of founding a large School of Botany that would collaborate with the Botanical Garden, but upon the wise advise of his good friend, Dr. Asa Gray, he did not undertake this phase of botanical work. Nonetheless, he was a firm believer in the needs of botanical education, and he reaffirmed this ideal in "An Act to Enable Henry Shaw to Convey or Devise to Trustees Certain Lands", which contained the following:- "--- to keep up, maintain, and establish a botanic garden for the cultivation and propogation of plants, fruit, and forest trees, and for the dissemination of the knowledge thereof among men, by having a collection thereof easily accessible; by the establishment of a museum and library in connection therewith, as also by the establishment of public lectures and instruction upon botany and its allied sciences, when it shall be deemed advisible in furtherance of the general objects of said trust."

Thirty years later, his probated Will contained a clause establishing the Henry Shaw School of Botany at the University of Washington in St. Louis. The professor of this School, to be known as the Engelmann Professor of Botany, was to be either the Director of The Missouri Botanical Garden, or next in rank to the Director. The Inaugural Exercises of the School were held in November, 1885. Professor William Trelease, an outstanding botanist, had been appointed the first Director and Engelmann Professor a few months previous.

Shaw further expounded his desires, showing thereby a keen foresightedness, in Clause 11, Article 5 of his Will, which states:- "I also declare that scientific investment in Botany proper, vegetable physiology, diseases of plants, study of forms of vegetable life, and of animal life injurious to vegetables, experimental investment in horticulture, arboriculture, etc. are to be promoted no less than instruction to pupils, the details of which I leave to those in charge."

The first Trustees of the Missouri Botanical Garden were selected by Shaw himself, and were named in his Will. Included on this Board were the following:- The Chancellor of Washington University of St. Louis; the Bishop of the Episcopal Church; the President of the Public Schools; the President of the Academy of Science of St. Louis; the Mayor of St. Louis; Dr. Asa Gray of Cambridge, Massachusetts; and Professor S. F. Bard, Secretary of the Smithsonian Institute. The successors to office of the first five named were automatically Trustees; whereby Dr. Gray and Professor Bard were chosen as honorary members of the Board.

When Professor Trelease undertook the Directorship

in 1885, he knew something of the problems that confronted him. The upkeep of the grounds had to be improved; construction of various sorts must be undertaken; the herbarium and library collections had to be enlarged; and plans for instructional education had to be formulated (see fig. 1). To increase the herbarium which contained some 2,000 specimens from Dr. O. Krause, 6,000 from Mr. S. B. Buckley, and in all some 20,000 flowering-plant and fern specimens, Professor Trelease gave his personal collection. In 1890, the famous collection of Dr. George Englemann, of some 98,000 plants, was given to the Missouri Botanical Garden.

In 1892, the Botanical Garden was the recipient of a famous and valuable literature contribution. Dr. E. Lewis Sturtevant, the first Director of the New York State Agricultural Experiment Station, gave his collection of 465 Pre-Linnaean books, as well as 52,000 odd index cards of Agricultural and Horticultural books, pamphlets, and bulletins, to the Garden.

When Director Trelease resigned in 1912, he had the satisfaction of knowing that the Missouri Botanical Garden had made great progress in the field of botanical science regardless of the difficulties and financial curtailments that he had to meet. The Garden had survived a tornado, hailstorms, extreme droughts, and severe winter killings. The herbarium contained 700,000 specimens, and the library had almost 70,000 volumes. The first plant physiologist was appointed to the scientific staff in 1909. The end of the heavy load of special taxes was in sight, and the addition to the Henry Shaw town house was finally completed. Plans for the present main conservatories were made in 1911. Everything presented signs for a happy future.

COURSE OF STUDY ----- 1890

(changed from a 6 year to a 4 year course -- 1892)

Fig. 1

Yr.	Month	Mon.	Tues.	Wed.	Thurs.	Fri.	Cr.
2	April to June	Flori. 3	Econ. Ent. 1		Survey. 2		6
	July to Sept.	Flori. 3	Econ. Ent. 2	Bookp. 1			6
	Oct. to Dec.	Flori. 1	Econ. Ent. 2		Survey. 1	Elem. Botany 3	7
	Jan. to March	Flori. 1	Twigs of Woody Plants 1	Orchard Culture 1	Land. Gard. 1	Elem. Botany 3	7
3	April to June	Veg. Gard. 4			Land Gard. 1	Botany, Wild Fl. 2	7
	July to Sept.		Econ. Mycology 1	Orchard 2	Land. Gard. 1	Botany, Gard. Fl. 2	6
	Oct. to Dec.		Econ. Mycology 3	Garden Accts. 1	Botany of Fruits 2		6
	Jan. to March		Econ. Mycology 3	Garden Accts. 1		Botany of House Pl. 2	6
4	April to June	Orchard Culture 1	Forestry 1	Bookp. 1	Survey. and Drain. 3		6
	July to Sept.	Small Fruits 4			Botany of Seeds 1	Botany of Veg. 1	6
	Oct. to Dec.	Special Gard. 2	Forestry 1	Veg. Physio. 2		Botany of Woody Pls. 2	7
	Jan. to March	Special Gard. 2	Forestry 1	Veg. Physio. 2	Bot. Geo. 1	Botany of Woody Pls. 1	7

Professor George T. Moore succeeded Professor Trelease as the Director of the Garden in 1912. Although he discontinued the Annual Reports, he inaugurated the publication of the Bulletin in 1913, and the Annals of the Missouri Botanical Garden, a quarterly, in 1914. In 1913, Director Moore cooperated with the Arnold Arboretum in sponsoring an expedition to the Southwest for the purpose of obtaining "a more complete representation of plants indigenous to the Southwest with the view of publishing flora of that region."(9) In that same year, he appointed a Curator of the Herbarium, and a Mycologist to the Garden.

During the first six years of Director Moore's administration, much thought and time was given to building, reconstructing, relocating, landscaping, and improving the Botanical Garden. Although he had reorganized the School for Gardening, which was inaugurated by Trelease, in 1914, he had to discontinue it during the First World War. Floral displays and other activities were also suspended for the duration. In 1918, the facilities of the Garden were offered to the Government, and members of the staff served on various war committees. In 1919 a program of vocational training for disabled soldiers was started.

The activities of the Garden returned to normal after the War, and several of its phases were reorganized. Plans for the "Henry Shaw Subdivision" were formulated in 1925 after a Court Decree had given the Trustees permission to dispose of some pasture land and purchase other land away from the atmospheric influences of the city - 50 miles west of St. Louis. This new undertaking was to be governed by the terms of Shaw's will. Throughout the years from 1925, when 1,300 acres were

purchased, until the present moment, construction, grading, planting, and landscaping have been the major problems in carrying out this extension of the Garden. It was always referred to as the Gray Summit until 1932 when the development of the nurseries, the construction of greenhouses, and other extensive improvements warranted the changing of the name to "Missouri Botanical Garden Arboretum".

The purpose of the later development is two-fold. In the first place, much time is devoted to the propagation and the growing of trees, shrubs, and plants for exhibition purposes at the city Garden, either indoors or out-of-doors. This important phase of the work avoids the existing difficulties of growing plants in the city atmosphere. In October, 1924, and again in December, 1927, a smoke pall settled over the city for two or three days each time, and ruined thousands of dollars worth of greenhouse plants. Other atmospheric disturbances such as severe wind storms, record hail-storms, cyclones, and severe ice storms have done great damage to greenhouses, plantings, and trees.

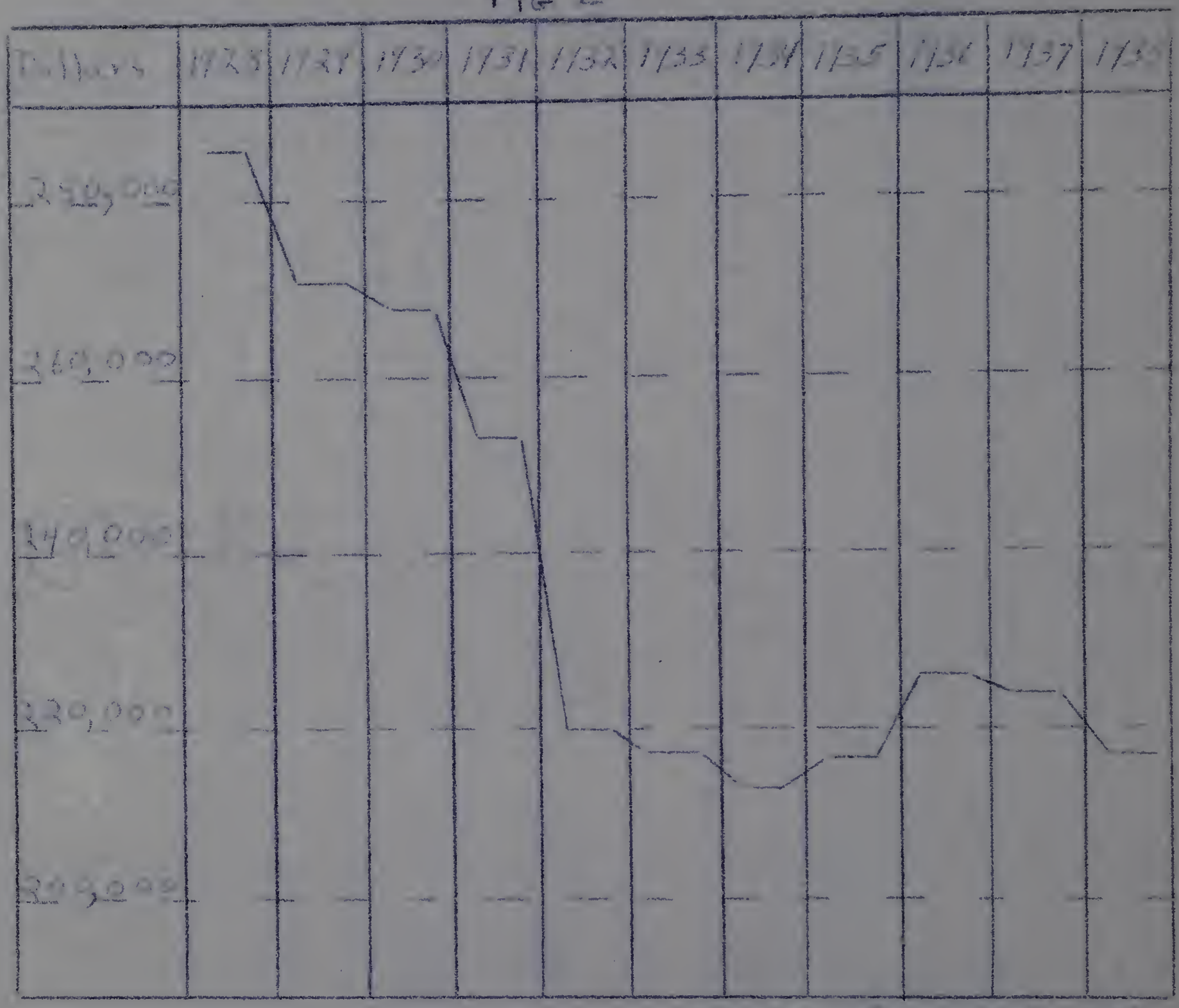
The tremendous amount of replanting at the city Garden, which comprises only 75 acres and some 12,000 species of plants, justifies in many respects the second purpose of the Arboretum. The Trustees of the Missouri Botanical Garden desire to improve the Arboretum with an idea that it will become the botanical garden of the future. A certain area of the Arboretum is being developed into a wild-flower reservation, and certain greenhouses are devoted entirely to orchids, where some 20,000 are cared for. A pinetum is also being gradually established, a phase that could not possibly be undertaken at the city Garden.

At the time that improvements at the Botanical Garden were being considered and plans for the new extension formulated, Director Moore realized the need of some undertaking that would further the Garden's studies of tropical plants. The Trustees approved his idea of establishing a station in the Tropics, and in 1926, land for such a purpose was purchased at Balboa, Canal Zone. This purchase was made through the Canal Zone Government, and was to have future significance to the Government. A house for the resident manager of the Tropical Station was built within a year, and the task of planning the part that the Station was to fulfill immediately became an active one. The project expanded and grew so rapidly that in 1932 extensive improvements and changes were made. Valuable scientific information and data, as well as specimens of plants of that Tropical region, were forthcoming. However, the control of this Station was short-lived. The Depression Years affected tremendously the working budget of the Missouri Botanical Garden, and it became necessary to assign the Tropical Station to the Government of the Canal Zone. In return for this transfer, the Botanical Garden continued to be affiliated with the Station in name.

The accompanying graph concisely illustrates the financial difficulties that the Missouri Botanical Garden had to contend with. (Fig. 2) As a matter of fact, optimism gave way to a feeling of pessimism in 1938. The income from the Shaw estate was sharply reduced by taxation while other city institutions and other botanic gardens of the world were supported out of tax funds. The cost of management plus the necessary

Income
of the
Missouri Botanical Garden

Fig 2



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estate taxes steadily mounted, while the current income declined to a point where the maintenance of the institution was threatened. The Missouri Botanical Garden must maintain itself according to the terms and intentions of Henry Shaw's Will. Since the death of Shaw - up to 1938 - the Botanical Garden had paid to the City of St. Louis $2,500,000 in taxes. This fact alone emphasises the soundness of Professor Gargent's thinking, and substantiates his persistent attempts to make the Arnold Arboretum part of the Park System of the City of Boston.

In 1939, the public was given the opportunity for the first time in the history of the Missouri Botanical Garden to assist in its development and maintenance. The immediate need was a fund of approximately $50,000. This was to be expended for bridges, fire protection, and roads at the Arboretum, thereby enabling it to be opened to the public at certain specified times of the year. In addition, a maintenance fund was needed. This fund of $25,000. was known as the "Friends of the Garden" fund. By the end of the year, the improvement fund was practically subscribed in its entirety, and the maintenance fund had reached a sum of about $7,000.

Regardless of these financial difficulties, the research and educational programs of the Missouri Botanical Garden were maintained at a high standard. In 1928, the School for Gardening Program was changed to an Apprentice Gardeners' Program. In 1939, these graduate apprenticeships were put on a more definite basis in cooperation with Washington University. During the school year these apprentices work three full days a week at the Garden and spend the rest of the

time as half-time students in Botany at the University in the Graduate School. In the summer they participate in the regular horticultural work of the Garden. The wages are equalized over the year at a rate of $11.00 per week paid by the Garden. To attract outstanding candidates, the University grants half tuition to these apprentices. This arrangement seems mutually advantageous to the apprentices, the Garden, and to the University.*

In 1937, the Botanical Garden cooperated with the St. Louis Board of Education in giving supervised instruction to the school children. During this same year, over 7,000 children had instruction on trees, plants, and flowers under the guidance of a special nature study teacher. High school classes had lessons in physiography, conservation, pollination, and interrelation between plants and insects. Even the kindergarten made use of the opportunities at the Garden by

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*Robert B. Clark, B. S., Massachusetts State College, was a Garden Apprentice in 1938 and 1939, studying taxonomy and morphology. He is the author of A HARDY WOODY PLANT NEW TO HORTICULTURE., Mo. Bot. Gard. Bul. Dec. 1940; and with William L. Brown: The Chromosome Complements of Bumelia lanuginosa., Amer. Jour. Bot., April, 1940; and in connection with Edgar Anderson and A. P. Beilmann has written EVERGREENS FOR ST. LOUIS., Mo. Bot. Gard. Bul., Nov. 1941.

Stanley Bettony, B. S., Massachusetts State College, M. S. Shaw School of Botany, was a Garden Apprentice in 1939 and 1940 in Cytology. He is the author of COLCHICINE TO AID THE PLANT BREEDER., Mo. Bot. Gard. Bul., June, 1940.

going on "Bird Walks" and "Nature Walks".

Although Dr. J. M. Greenman spends most of his time on curatorial duties, he has done research work in taxonomy on the flora of the Southwest, and the Compositae. The Mycologist of the Garden, Dr. C.W. Dodge, completed a manuscript in 1938 on the Botany of the Second Byrd Antarctic Expedition, although Mr. Paul Siple was the botanist of the Expedition. Mr. Siple wrote the ecological and geological part of that report. Important studies in genetics have been undertaken by Dr. Edgar Anderson, the Geneticist of the Garden and Engelmann Professor. Dr. R. E. Woodson, Jr. has spent several years on a revision of the species Asclepias in the United States concurrently with a survey of all genera of Asclepiadaceae in North America.

The Missouri Botanical Garden has lately encountered war-time difficulties, and consequently has been compelled to operate upon a maintenance budget. Needless to say that plants and their products are supplying contributions to medicine, food supplies, manufacturing industries. Many of these articles are recognized as essential for the first time. The Garden has supplied instructions and literature on poisonous and edible plants in those vast regions where our servicemen are now located. It has also cooperated with the American Quinine Co., the Bureau of Plant Industry, the Rubber Development Corporation, the Quartermaster Corps, and other drug houses. Nine former students or members of the Staff are located in Central or South America for the purpose of investigating rubber and quinine.

THE NEW YORK BOTANICAL GARDEN

Two years after the opening of the Missouri Botanical Garden as a botanical institution under the control of Trustees, the Legislature of the State of New York authorized "An Act to provide for the establishment of a botanic garden and museum and arboretum, in Bronx Park, in the City of New York, and to incorporate The New York Botanical Garden for carrying on the same." The purpose of the Act was the collection and culture of plants, shrubs, flowers, and trees, for the advancement of botanical science and knowledge, and for the prosecution of original researches, for the affording of instruction in the same, for the prosecution and exhibition of ornamental and decorative horticulture and gardening, and for entertainment, recreation, and instruction of the people.

The control and management were invested in a Board of Managers by law. Included on this Board were the President of Columbia College, the President of the Torrey Botanical Club, the President of the Board of Education of the City of New York, the professors of Botany, Geology, and Chemistry of Columbia, and their successors in office. This group was to be known as the Scientific Directors, who were ex-officio members of the corporation and of the Board of Managers. At least nine other managers were to be elected by the corporation members.

When a sum of money not less than $250,000. was raised - an amount sufficient in the judgement of the Board of Commissioners of the Department of Public Parks in the City of New York - the Board of Commissioners was authorized to appropriate land not exceeding 250 acres

in Bronx Park to the corporation, or as amended in 1894 - "such other of the publicparks north of the Harlem River as may be mutually agreed upon ---".

This amount of money was subscribed by June, 1895. At this time, the Board of Estimate and Apportionment of the City of New York was authorized to issue bonds or stock, payable from taxation, aggregating the sum of $500,000., not exceeding 3% interest, redeemable within 30 yewrs. This money was to be used for the construction of buildings and for the purchase of equipment.

It is apparent that from the beginning this institution was to be supported by taxes, and not be subject to taxation. The present sources of income are from private subscriptions, the endowment, annual appropriations from the City of New York, and membership dues. At present there are eight membership classifications, ranging from fees of $10 upnto $25,000, divided into two groups, annual payment and single contribution.

The New York Botanical Garden was less than a year old when it entered into an agreement with Columbia University; such agreement, however, could be terminated upon one year's notice to either party. The University agreed to deposit its herbarium and botanical library with the Botanical Garden. In return, the officers and students had free access to the entire herbarium and library in years to come; the College could conduct courses in boteny and kindred subjects at the Garden; all courses conducted by the Garden were to be open to officers and students; botenical material was to be supplied to the College; the public schools, and other public educational institutions; and the

College could recall any part of the Herbarium and Library at any time for undergraduate instruction.

The first educational program undertaken by this new institution was the labeling of some 500 trees of 40 kinds on the area. This did not include the famous Hemlock Grove, however. The start on the Botanical Garden's fungus collection, which is exceeded today only by the collection of the United States Department of Agriculture and the Herbarium at Harvard University, was made in 1895. The Scientific Directors recommended the purchase of the valuable and unique herbarium of Mr. J. B. Ellis, containing some 75,000 specimens.

In 1896, a Commission was set up to prepare a general plan of development. A thorough report with recommendations was submitted by the Commission in the Fall of that year. That report contained a study on general considerations, entrances, borders, driveways, buildings and their locations, specimen trees, decorative grounds, pinetum, deciduous arboretum, fruticetum, viticetum, herbaceous grounds, rockery, bog garden, lakes and ponds, the Bronx River, economic garden, permanent nurseries, forest areas, meadows, water supply, sewage disposal, grading, surface drainage, subsoil drainage, illuminating gas, and reserve areas. The Commission was determined on results in its undertaking and nothing was left undone. Although the plan was elastic in its recommendations, the whole tract was apparently ecologically adapted for all the purposes for which it was to be used.

Professor N. L. Britton was one of the founders of the New York Botanical Garden, and was its first Director-in-Chief, as well as the first Secretary for the Board of Managers. Under his active leadership

the plantings, landscaping, grading, and drainage programs progressed rapidly. Although the museum and range of horticultural houses were not completed until 1900, accessions of all kinds were continually received in large quantities. Those that could not be cared for in temporary quarters were stored in buildings of other institutions. All through these early years a nursery was established and maintained to supply plants, trees and shrubs for the grounds. Through the generosity of Columbia University, the New York Botanical Garden had the use of a temporary greenhouse at Morningside Heights. This greenhouse was operated to capacity at all times.

The museum building is designed in Italian Renaissance style, where regularity is confined to the two chief stories. This building contains the administrative offices, classrooms, laboratories, an auditorium, the library, and the herbarium. As early as 1896, it was proposed that the entire first floor be devoted to the economic museum. Professor Britton wanted this to be a special feature of the Garden. This display was to be arranged by products, crude and commercial, together with the process of manufacture. The second floor of the museum was divided into five sections: General Botanical Museum, Physiological Museum, Palaeobotanical Museum Collection, Illustration of the Flora of the Region of 100 Miles about New York City, and Special Collections.

The Range of Horticultural Houses consists of 13 buildings with a palm house as the central feature. The entire structure is rectangular, thereby enclosing a large court. This court is utilized for aquatic plants and ornamental features. The style is in keep-

ing with the Museum, which is modernized Italian Renaissance.

Dr. H. H. Rusby was appointed Honorary Curator of the Economic Collections in 1898. He accepted that important task with enthusiasm, and immediately set to work. The Collection was to be established upon a more distinctly and systematically educational basis than ever was attempted anywhere by this type of institution. Realizing that the accumulation of economic plants would be a slow process, and that the exhibits regarding production and manufacture of plant products by commercial companies would present difficulties, Dr. Rusby had to rely upon a limited purchase and a promissory exchange method. Funds were not adequate to make extensive purchases or acquisitions by collections. Donations of any large amounts of material were problematical. The limited purchase fund was divided into two parts, namely; to pay the necessary expenses of exhibits secured by unpaid friends and correspondents, and to pay for collections made by special expeditions.

Apparently this was a practical means of securing economic collections because the New York Botanical Garden immediately received an industrial exhibit of the turpentine industry from Dr. Charles Mohr of Mobile, Alabama. An exhibit of the Zante currant and date industries was forthcoming that same year. Professor P. H. Mell of Alabama Polytechnic Institute agreed to supply an exhibit on the production and marketing of cotton. An agreement with a special expedition of a Mr. Fairbanks resulted in a collection of certain rare plants of Pernambuco, Brazil.

The promissory exchange method required a special

program of collecting materials of authenticated origin. It was therefore decided to employ Professor A. A. Tyler of Syracuse University as a part-time collector. By this method all economic specimens exchanged would be accompanied by an herbarium specimen and a complete record of the details of collection. Dr. Tyler collected 20 sets of 80 species in the vicinity of Easton, Pennsylvania the first summer. Exchanges were offered through the means of a circular, and acceptances were made by the Instituto Medico Nacional of Mexico, the Technological Museum of Sidney, Australia, and the Government of British India.

At the end of the first year of this educational and scientific program, the following exhibits were either received or promised by commercial industries:

A set of specimens, photographs, and implements of the opium industry in Turkey.

Photographs of fig-packing in Smyrna.

Exhibit of the perfume industry at Grasse.

Exhibit illustrating the principles of standardization of drugs on the basis of their percentage of active constituents.

Illustrations of the olive and nutmeg industries.

Exhibit of the volatile oil industry.

This was an auspicious beginning which gave every indication of a successful and promising future.

At the beginning of the year 1900, the Director of the Laboratories, Professor D. T. MacDougal, reported that 20 graduate students had done work connected with the New York Botanical Garden. In the same year the Report of the Scientific Directors contained an outline of research courses offered to officers of the Garden

and to the Botany Department of Columbia University. The outline of that educational program, which follows, was well-defined.

Physiology of the Cell
Ecology
Morphology of Algae
Morphology of Fungi
Morphology of Bryophyta
Morphology of Pteridophyta
Morphology of Spermatophyta
Experimental Morphology
Taxonomy of Algae
Taxanomy of Fungi
Taxonomy of Bryophyta
Taxonomy of Pteridophyta
Taxonomy of Spermatophyta
Taxonomy of Gramineae
Embryology of Spermatophyta
Special Taxonomy
Regional Botany
Physiology of Nutrition
Ecological Physiology
Physiological Anatomy
General Physiology

These advanced courses cover practically every phase of Botany, and were acceptable for advanced degrees at Columbia University. Students taking these courses had to be approved by the Director, and were required to pay a fee of $15. an hour per week per year up to 10 hours per week. This was equivalent to $150 per year (taken as 36 weeks). If a student did not have the means of paying this fee, he had the opportunity of working at 25 cents an hour on collections , or of supplying books, specimens or plants in value equal to the fees. Here again the Director determined the value.

In a report by Director Britton to the Executive Committee in 1916, relating to further development of the Garden, the property valuation of the New York Botanical Garden was about $14,000,000. Of this valuation a goodly amount was assigned to the herbarium, library and plantations. The herbarium contained over 1,500,000 specimens; the library had some 28,000 volumes; and the plantations comprised some 14,000 spedies and varieties. These collections continue to be of great educational and scientific value; some have attained interwational significance.

All through these years $10,000 was spent annually for the development of the grounds alone. In 1915 the City of New York added a tract of 100 acres to the original grant. In that year about one-third of the second conservatory range had been completed - this to be used as a display greenhouse for horticultural purposes. There was urgent need for one wing of the museum, which had been contemplated in the original plans. More room was needed for laboratories, the library, storage of specimens, and lectures. Director Britton estimated that gifts aggregating $500,000 would accomplish the work outright, or the interest from an equivalent endowment might do the same in 10 years. He felt that resources were urgently needed if the valuable property and the scientific staff were to be utilized properly and efficiently.

The proposals of Director Britton were approved and subsequently carried out, so that the New York Botanical Garden expanded and flourished under his conscientious and far-sighted policies. He was its Director-in-Chief until 1929. For 34 years, Professor N. L. Britton was devoted to his profession, and was largely responsible for publications of the Garden. The Journal and Memoirs were published in 1900; North American Flora in 1907; Mycologia, the official organ of the Mycological Society of America, in 1909; and, Addisonia in 1916. The irregularly issued Brittonia, in his memory, was established in 1931 when the Garden was under the directorship of Professor E. D. Merrill. Professor Merrill served in that capacity until 1935 at which time he accepted an important administrative position at Harvard University.

Several important features and changes at the New York Botanical Garden were inaugurated under the administration of the latter. His work naturally was impeded by the depression, but by sound economic management practically all of the borrowings on the endowment funds, about $50,000., was restored by 1935.

In 1932 the Garden cooperated with the Horticultural Society of New York and with the National Association of Gardeners in establishing the School of Professional Gardeners. It offered courses in botany and practical gardening, and academic credit was given for the completion of these courses. This School has added much to the scientific and educational program of the Garden. Extension courses in gardening, which have been given in March and again in October and November, have always been well attended.

The scope and activities of the Garden becgme so outstanding and enlarged that it became necessary to have the Act of Incorporation of the New York Botanical Garden amended. This amendment was approved in 1933 and contained a few significant changed over the original program. The Garden could establish and maintain a botanical garden and museum and arboretum elsewhere within or without the State of New York. The Torrey Botanical Club and Columbia University had the right to appoint one and four persons respectively to the Board of Managers for definite or indefinite terms of office. These managers could be removed from office by the Club and University. The Board of Estimate and Apportionment could appropriate the whole or any part of the land in Bronx Park for further extension and development of the New York Botanical Garden.

In 1936, Dr. Alexander P. Anderson agreed to establish a permanent research and fellowship fund by adding $15,000 to a previous gift of $10,000. The first fund was used for research in the laboratories and gardens. The additional gift was intended to finance fellowships for research workers doing advanced studies at the Garden, with preference given to college and university graduates. Dr. Anderson was a former research worker at the New York Botanical Garden at which time he developed puffed rice and puffed wheat. The Alexander P. Anderson and the Lydia Anderson Research and Fellowship Fund finances the work of young scientists who are investigating important botanical problems.

In 1919, the authorities of the Garden gave Dr. A. H. Stout permission to work in cooperation with the Department of Pomology of the New York State Experiment Station for the purpose of breeding a seedless grape that was hardy in the climate of central New York. The inheritance of seedlessness, and the nature and scope of seedlessness of various types were other details proposed for investigation. The first seedling to produce seedless berries fruited in 1926, but it was not until 1936 that a satisfactory plant of the kind was developed. This new grape was named the BRONX SEEDLESS GRAPE. Dr. Stout has also been responsible for the production of fast-growing poplars, which are so important to the paper pulp industry , and for extensive studies on the hybrid day-lilies (Hemerocallis). The investigation of poplars was undertaken in cooperation with the Oxford Paper Company, and hybrids have been distributed throughout foreign countries as well as in America.

The Nathaniel Lord Britton and Elizabeth Gertrude Britton Fund was an endowment fund stipulated in the will of the former Director and Founder of the Garden. The Garden received one-sixth of the residuary estate. The income from the fund was to be used for botanical and horticultural research, exploration and publication, and the increase of collections of plants, books, and specimens, but not for maintenance or construction.

Since the death of Dr. N. L. Britton, the New York Botanical Garden has been served by four Directors: Dr. E. D. Merrill, Dr. M. A. Howe, Dr. H. A. Gleason, and Dr. W. J. Robbins.

The scientific work of the institution has been so far-sighted in scope that men, materials, and information have been immediately available for serving the critical needs of our country during the current trying days.

THE BROOKLYN BOTANIC GARDEN.

The New York Botanical Garden was 15 years old when the Brooklyn Institute of Arts and Sciences was given authorization by the State Legislature to establish a botanic garden as one of its departments. This authorization came about because a group of public-spirited citizens desired to eliminate and make more attractive a tract of land that was used for the burning of refuse by the park department. Their idea was to have a botanic garden under private administration. In the 34 years that have intervened, that eyesore in the heart of Brooklyn has become the most beautiful spot in the Borough, and is annually visited by approximately 2,000,000 people.

In accordance with the Act of Legislature of 1897, the purpose of the Brooklyn Botanic Gorden is as follows:- "For the collection and culture of plants, flowers, shrubs, and trees, the advancement of botanical science and knowledge, and the prosecution of original researches therein and in kindred subjects; for affording instruction in the same, and for the prosecution and exhibition of ornamental and decorative horticulture and gardening, and for the entertainment, recreation, and the instruction of the people."

The founders of the Brooklyn Botanic Garden desired an educational program more extensive than any other ever attempted by any botanic garden. The educational program began in the Fall of 1910 when the first director, C. Stuart Gager*, had offices in temporary quarters, and the Garden had not even been turned over to a Board of Trustees.

The Garden receives an annual appropriation from the New York City Tax Budget, as well as the income from endowments and fees for membership. The appropriation from the city is expended for permanent improvements and annual maintenance. The contributions of private funds for improvements supplement those of the city, are expended also for scientific and educational work, and for the administration of the Botanic Garden. The original agreement required the Board of Trustees to provide only $50,000., but throughout the years it has secured well over $2,000,000, of which a substantial amount has been given as permanent endowments.

The City of New York has been very liberal, broad-minded, and generous in support of its educational and cultural institutions. In the cases of the Brooklyn

*Deceased - August, 1943.

Botanic Garden and the New York Botanical Garden, it provided the site, it retains ownership of the institution, it makes contributions to the upkeep, and it exempts the property from taxation. However, one-half of the initial cost of the Laboratory Building and Conservatories at the Brooklyn Garden was provided from private funds. The entire cost of the Rose Garden, the Japanese Garden, the bridges, the Conservatory Plaza, and the Robert Young Gate came from private funds. The cost of publications for the Library, specimens for the Herbarium, living plants for the gardens, and the Conservatories, have been met by appropriations from the Garden.

There have been seven classes of membership at the Brooklyn Botanic Garden ranging from an annual member, who contributes a $10 fee, to a benefactor, paying $100,000 or more. All memberships excepting the annual type carry full privileges in the other departments of the Brooklyn Institute of Arts and Sciences. These memberships also carry certain out-of-town privileges and are affiliated with other cooperating institutions and organizations which range from Vermont to California. They do not include free admission to the Philadelphia and Boston Flower Shows, however.

Although the botanical exploration program of the Brooklyn Botanic Garden has not been extensive, it did cooperate with an expedition to Western Cuba, and it assigned a botanist to the Mulford and Astor Expeditions, the former exploring the Amazon basin, the latter studying the Galapagos Islands. Its own expedition has studied the wild and cultivated Iris of Japan - a detail resting in large measure upon the development of the Japanese Garden under the direction of Miss Mary Averill, Honorary

Curator of Japanese Gardening. Miss Averill was appointed to the staff in 1919. A gift of $12,500 from Mr. Alfred T. White in 1915 made the construction of the Japanese Garden possible. It was designed after a Niwa by a Japanese landscape architect, Mr. Takeo Shiota.

In 1919 and 1920, Mr. White made another gift of approximately $20,000 to the Garden for construction of the Conservatory Plaza and Waterlily Pool. The sum total of all his generous gifts was the equivalent to a Benefactor membership. He was one of six that the Garden has ever had. He has been called "the father of the Botanic Garden".

A tentative outline of an educational program for the Brooklyn Botanic Garden was drawn up as early as 1911. It embodied 14 distinct features, namely: labelled collections, correlation of work with local schools, public lectures to adults, special lectures, lecture courses, courses in instruction, public demenstrations and exhibitions, docentry, the library, bureau of information, supply department, advanced study and research, presentation of papers, and publications. It was so thorough and broad in scope that it is still followed in large measure. (Fig. 3)

It has always been the desire of the officials of the Garden to serve the City to the limit of its capacity. The most effective and far-reaching plan has been one of practical cooperation with the public and private schools. (See map) There are thousands of children in the congested areas of large cities who have never walked in woods, or fields, and who have never seen wild flowers. The Brooklyn Botanic Garden brings a bit of the wildwood to the city, and the children have

BROOKLYN BOTANIC GARDEN

Organization of Educational Work

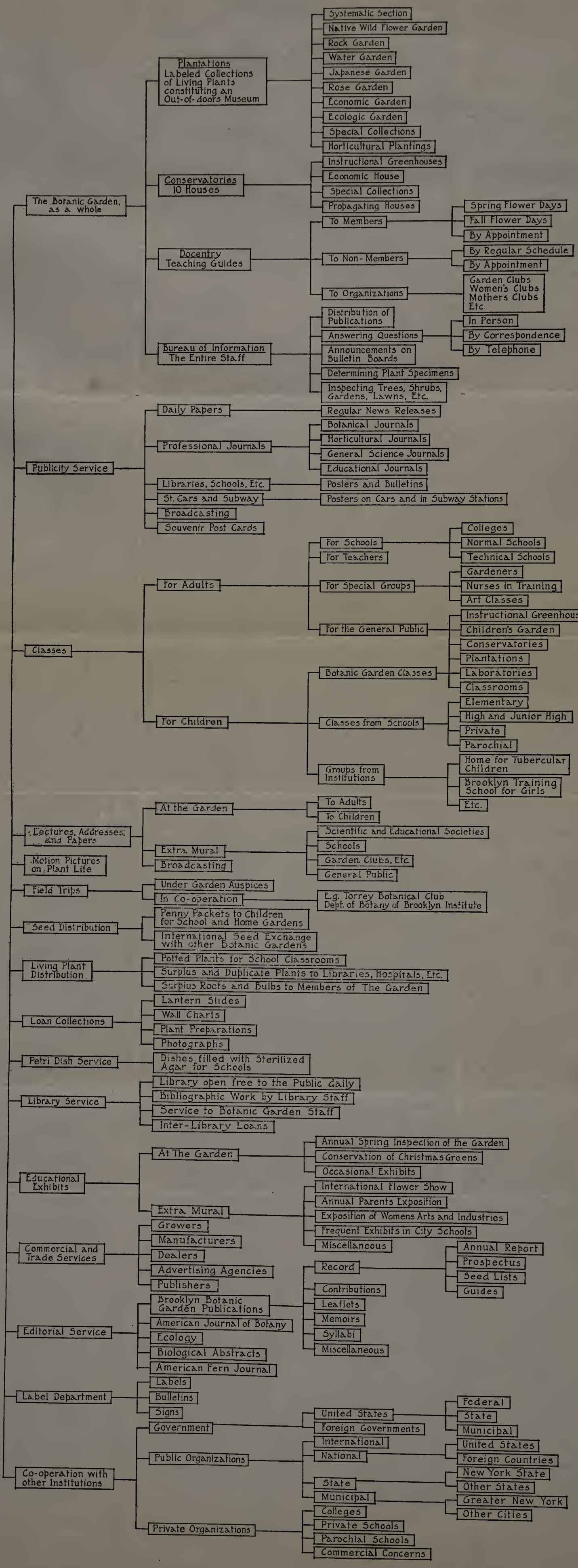

FIG. 21. Map of Brooklyn, showing the location of schools that are being served in one way or another by Brooklyn Botanic Garden. Open circles designate High Schools, all of which are being served; solid dots in circles designate Elementary schools (the so-called "Public Schools"), most of which are being served; a horizontal line through a dot in circle designates a Junior High School; a cross, Parochial school; a cross in a circle, Parochial High School; P, Private school (not parochial); T, Training School. A solid dot, elementary school not being served by the Botanic Garden. There are only 8 of these in Brooklyn.

responded magnificently. The Botanic Garden has been an exceptionally valuable adjunct to the work of students in nature study, botany, and even geography. The facilities of the Garden enrich the school work.

In 1913, some 500 students, representing about 5% of the schools, availed themselves of the opportunities for class instruction at the Garden. In 1920 the number brought to the Garden by their teachers exceeded 20,000 pupils. 100% of the high schools and 78% of the elementary schools were using the facilities offered at that time. The annual number of pupils now is well over 50,000. The subjects discussed in these classes are directly related to the school curriculum. At the beginning of each term the Garden distributes the list of subjects. The pupils are given a syllabus to facilitate the "follow-up" work when the class returns to school.

The Botanic Garden has not relied entirely upon the public and private schools for disseminating botanical information. It has conducted its own school open to adults, teachers, nurses, and children. Included are lessons about the plantations and conservatories, practical laboratory exercises in plant propogation and plant growth, uses of plants and plant forms, the drawing and painting of plants, and flower arrangement. The attendance at these classes has exceeded 50,000 people annually.

Several courses for members of the Garden are open to students of Long Island University and New York University in the undergraduate program. Credit towards an advanced degree is given for research work at the Garden to students of both Universities.

In cooperation with the Brooklyn Teachers Association the Garden offers courses to teachers in botany, horticulture, floriculture, and nature study. Most of these comprise 30 sessions with a varying amount of laboratory work.

The children's courses comprise 30 Saturday morning sessions in the Fall, Winter, and Spring. The Outdoor Garden Course features the maintenance of a garden throughout the summer season. This course is limited to approximately 200, and the Spring Course is a prerequisite. Each boy or girl has to satisfactorily perform the preparatory work in plant and soil study. The children's greenhouses and classrooms afford the opportunity for practical work in propogation, transplanting, potting, and general care of plants.

The aim is to educate boys and girls, not to raise plants. Gager(4) states it thus: "Knowledge and character are the crop --- the vegetables and flowers a by-product". By doing this type of work for a period of 6 to 8 years many children have discovered their main interest in life. Some have gone into the florist business; others have started nurseries; and others have gone on to college, specializing in botany or horticulture. To give encouragement to this latter group, the Garden awards annually a $100 scholarship for work of superior merit. Sustained interest in all the work is expressed by the activities of the Boys and Girls Club of some thousand members. They have published their own paper "Agricola", presented various garden programs, and awarded prizes in recognition of outstanding work to its own members. They emphasize education, strive for a direct contact with nature, and

set forth courses of study that are related and progressive.

As early as 1914 the Garden began supplying penny-packet flower andvegetablg seeds to school children. The Garden took the initial lead in establishing back-yard gardens during the First World War, and 25,000 seed packets were called for. A steady increase in the number of packets has taken place from ye ar to year , and in 1930 over 700,000 were sold to over 240,000 children. The Victory Garden Campaign of this present conflict is increasing the demands on this department to well over 1,000,000 packets a year.

Another important phase of the educational program is the distribution of living plant materials. All plants raised by pupils at the Garden become theirs; all visiting classes receive a potted plant for their classrooms; duplicate potted plants are placed in hospitals and public libraries; surplus propagating materials are distributed to Garden members in the springtime; and, propagating material is exchanged with other growers.

The Botanic Garden maintains a bureau of information which comprises all of its staff members. They give information on all the aspects of plant life and gardening. Its library of 35,000 or more books, pamphlets, and periodicals renders an important public service. Horticultural and botanical exhibits are installed at flower shows and at schools, and special leaflets are distributed free of charge. The petri-dish service and the loan collections to the schools have been valuable contributions to public education.

No attempt has ever been made to develop an extensive herbarium beyond the point of illustrating the

flora within a radius of 100 miles of Brooklyn. At present the herbarium contains about 170,000 plants, including phanerogams and cryptogams.

Much emphasis has, however, been placed upon the study of local flora in the research department of the Garden. From the very beginning, investigations in morphology, physiology, evolution, genetics, and pathology have been foremost in the studies of the staff, which has also carried on extensive work in the problem of disease resistance. Garden investigators assisted in discovering the physiological species in the plant smuts that are so destructive to the cereal grains. The Brooklyn Botanic Garden maintains the largest known collection of the varieties of the Boston fern, and they have been used in connection with studies in plant genetics.

In 1930, the Botanic Garden inaugurated a radio broadcasting series over Station WNYC. By cooperating with other agencies it was able to expand this program until 1936 when a coast-to-coast network was at its disposal over Station WOR. Printed programs and digests were distributed until June, 1941, when the facilities to the Radio Garden Club were terminated in favor of a commercial organization.

Since the outbreak of the war, the Garden has made outstanding contributions in both research work and "Victory Garden" projects. The future of civilization depends upon the children, and the Garden continues to cater to the education of children. It fosters the scientific method, and has continued faith that the children can be trained to assemble and to analyze facts objectively, and to draw logical conclusions therefrom. The future of scientific research lies in those who are now children.

THE BOYCE THOMPSON SOUTHWESTERN ARBORETUM.

The most recent and perhaps highly specialized botanical institution today is the Boyce Thompson Southwestern Arboretum at Superior, Arizona. Few people realize that Arizona is noted for such a wide variety of interests as its copper mining industry, healthful climate, winter resorts, and its beauty in desert and mountain scenery. Fewer people realize that its future lies in agricultural development, and not in copper mining or the tourist trade.

As early as 1865 a Federal Governmental Committee surveyed the agricultural and home-making possibilitees of the sub-arid portions of the Southwest, and to its dismay found nothing very encouraging to report. Although they discovered a small amount of native growth good enough for cattle grazing, they reported that crops could not be grown successfully, and that the long hot summers would blight any crop before it matured. That Committee was honest in its opinions, but in the early 1920's Col. William Boyce Thompson decided to do something constructive agriculturally for Arizona as he had done in mining.

Col. Thompson was a Westerner born and bred. Although Montana was his home State, his mining interests attracted him to Arizona where he became appreciative of the natural beauty and climate. He had an intensive love for plants, and knew man's dependence on them. This led to the establishment of the Boyce Thompson Institute for Plant Research at Yonkers, N. Y. Further realizing that little progress had been made in developing and bringing into usefulness the many wild

forms of plant life, particularly dry-climate types, he became interested in them and in their potentialities.

When he retired in 1923, he built Picket Post House, reminiscent of his horseback rides and trips over the winding trails of old Arizona during his mining days, as a winter home on a beautiful site which is now part of the Arboretum proper. Even then he desired to make a definite contribution to plant research of that region; something that was more than mere botanical propagation. He wanted to benefit the State and the entire Southwest. Accordingly, he visited many scientific institutions, consulted some of the best plant authorities, and secured definite information before he proceeded with any practical plan. This characteristic habit had served him well in the copper mining industry, and those who knew him anticipated great things from his new undertaking. The result was the Boyce Thompson Southwestern Arboretum.

In 1924 the State of Arizona had no Statutes providing for a non-profit, tax exempt, scientific research corporation. Col. Thompson prevailed upon the good offices of the Governor and a special legislative Act was approved March 7, 1925. The revised Code of 1928 is as follows:- "Corporations may be formed for research, investigation, and experimentation in agriculture, horticulture, biology, botany, arboriculture, and other subjects scientific. When any such corporation shall be organized not for profit and shall have no capital stock, all property of such corporation, used for its purposes or connection with its work, including all property held by or for such corporation for the carrying on of the work thereof, shall be exempt from taxation

so long as the same shall be used for such purposes only, and not used or held for profit."

In October, 1927, William B. Thompson, Charles F. Ayer, and Edward W. Rice signed the Articles of Incorporation and comprised the first Board of Directors. Although the nature of the business and the purposes of the Arboretum are given in detail and cover every conceivable phase, the present purpose is "to bring together and grow, for study and possible utilization, the plants of sub-arid climates and to publish the results of such investigations".

In the same way that Henry Shaw took an interest in the first plantings and early development of the "Shaw Gardens", so we find Col. William Thompson enthusiastic and full of anticipation. He once remarked, "It is a big job, but we will build here the most beautiful, and at the same time the most useful, garden of its kind in the world". Even after Professor Franklin J. Crider accepted the opportunity of organizing and directing the work of the Arboretum in 1924, Col. Thompson took great delight in surveying trails and roads, planning various details, and designating places for choice trees. He believed that every feature should be planned for permanency, and that the development should be a gradual process. He insisted that a plan be made for every new development.

A large part of the lands of the Arboretum had to be acquired from the Federal Government because it was located within the boundaries of the Crook National Forest. In the first place, Col. Thompson had to secure a special usage permit from the Forest Service for the 20 acres that he acquired when he built his house. Since that time various tracts of land have either been

exchanged, acquired, or transferred from the Government holdings of from the Mining Companies. Now there are some 1700 acres for arboretum purposes. The Arboretum is situated at the foothills of the Pinal Mountain Range with Queen Creek and Arnett Canyons passing through it, and Picket Point Mountain adding a contrast by towering up some 4,000 feet.

Queen Creek Canyon is fertile land and had previously been a part of a farm. Although the stream dries up in the summer, it is the source of water for the irrigation system of the Arboretum. A 45 foot well and a tunnel were constructed in 1925 from which underground water is taken to a storage reservoir of 3,700,000 gallons capacity.

The first permanent constructions for propagating and handling of plants were built in 1925, and the Administration Building was erected in 1926. It is of native rock covered with lichens. The building is practically fireproof, and provides ample space for a library, offices, laboratories, seed room, herbarium, and supply rooms. Two greenhouses adjoin this building.

The annual rainfall of the region averages about 17 inches and comes at two seasons of the year -- midsummer and winter. The Temperature varies from 25 to 112 degrees. The Arboretum has to contend with these austere factors, and the agricultural development is in direct relation to the water supply and to the water efficiency of the cultivated plants. Therefore, the research program has been more or less laid out for the Arboretum. The Scientific Staff has been searching for drouth-resistant varieties of plants; it has been selecting, breeding, and propagating new types that have low

water requirements; and, it has been studying the fundamental factors which contribute to Xerophytism in plants.

Many promising exotics have been brought in from Australia, North and South Africa, and central Asia for investigation. Many wild types have been improved by cultivation, until they surpass in beauty, color, and form many of the commercial forms. Among such are species of Mortonia, Baccharis, Cowania, and Psoralea.

A great deal of consideration is given to the root systems of plants. Plants are grown under two general methods --- with irrigation and cultivation, and without either irrigation or cultivation. The latter treatment deals with plants that are expected to maintain and reproduce themselves under natural conditions and which are useful as forage crops, watershed protectors, timber trees, firewood, and soil-binders.

In the plantings more attention is given to the plant as an individual than to its botanical, geographical, and landscape relationships. Specific characteristics and local adaptation are the deciding factors.

The Boyce Thompson Southwestern Arboretum has always been supported by the endowment of its founder, and the Director, Frederick Gibson, who succeeded Professor Crider in 1934, is responsible to the Board of Directors. There has never been an official publication that is comparable to the annual reports of other scientific institutions. None-the-less this scientific institution fills an unique position in the field of botanical science today, and it has been of service to the State of Arizona, the Southwest, and to the world at large.

CONCLUSIONS.

In the foregoing pages we have seen how botanic gardens have evolved from medicinal gardens of the Mediaeval monks and the physic gardens of the herbalists to the present great scientific institutions for the advancement and diffusion of a knowledge and for the love of plants. The early inherited interest of Graeco-Roman pharmacology has declined throughout the years. This aspect has been overshadowed by other phases of the present day gardens which are outgrowths of interests either amateur or scientific. They are administered for a dual function: (1)popularization, and (2)technical research.

Many lessons have been learned from the history of financing such institutions. There is a vast difference among grants of kings and governments, appropriations of municipalities from tax funds, and endowments and bequests from private sources. Monetary fluctuations and systems of taxation will always affect such educational and scientific institutions as botanic gardens.

Botanic gardens today are living embodiments of the scientific habit of thought and work. They are creative and productive centers, constantly enriching the field of plant knowledge. Consequently the most effective type of work that they undertake, for both adults and children, is that which gives scholarship and culture as well as technical skill and information.

The author is of the opinion that the small collegiate botanic garden should not be abandoned even though the scientific and educational facilities of the large botanic gardens are always available. Some of the best

semi-arid plants in this country are to be found on the campuses of our Southwestern universities. Several of our colleges have been developed within arboretums. Colleges and botanic gardens have always been, and will continue to be, associated with the principles of peace, health, and beneficent work, ever evolving new means of delivering man from the scourges that beset him.

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